SEDIMENTOLOGY AND PALEOALGOLOGY OF THE CENOZOIC SEDIMENTS OF KACHCHH OFFSHORE BASIN, INDIA: SIGNIFICANCE IN RECONSTRUCTION OF PALEOENVIRONMENTS AND HYDROCARBON EXPLORATION

SYNOPSIS

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BY

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(1) Specific Title:

"Sedimentology and Paleoalgology of the Cenozoic Sediments of Kachchh Offshore Basin, India: Significance in Reconstruction of Paleoenvironments and Hydrocarbon Exploration"

The Kachchh offshore basin, India is situated between the petroliferous Bombay offshore basin in the south and southeast and petroliferous Sind-Indus geological province in the north. The Kachchh basin covers an area of approximately 71, 000 km^2 , out of which 28, 000 km^2 area falls in offshore within 2000m water depth and remaining forms on-land part of the Kachchh area (Mishra, 2009). This basin is classified as pericratonic rift basin (Biswas, 2002).

The Kachchh offshore Basin is filled with sediments ranging an age from Early Cretaceous to Holocene (Mishra, 2009). In order of superposition, the various important formations are: Bhuj Formation (Santonian to Neoconian); Mundra Formation (Coniacian to Maastrichtian)/Naliya Formation (Santonian); Deccan Trap (Maastrichtian to Danian); Nakhtarana Formation (Thanetian, Late Paleoecene); Jakhau Formation (Ypresian, Early Eocene); Fulra Limestone Formation (Late Middle Eocene); Tuna Limestone Formation (Rupelian, Early Oligocene); Naryansarovar Formation (Upper Oligocene); The Godhara Formation (Miocene) and Chhasara Formation (Early to Middle Burdigalian) (Zutshi et al., 1993; Pandey and Dave, 1998); Mishra, 2009). The following description of various Cenozoic formations is after Raju (2009).

The Nakhtarana Formation (Late Paleoecene) is 52 m thick in type section. This formation has three members, Nakhtarana Limestone, Nora and Anjar. The Nakhtarana Member is consisting of white buff, fossiliferous compact limestone along with alternations of siltstone. The Nora Member is composed of claystone lithounits with minor basalts and fine grained sandstone. The Anjar Member is consisting dominantly sandstone and shale-sandstone alternations in lower part. The environment was inner shelf for upper part and non-marine to marginal marine for lower part. The Jakhau Formation (Early Eocene) is 255 thick and consists of dominantly argillaceous limestone having coal bands at the top. The environment was shallow warm water. The Fulra Limestone Formation (Late Middle Eocene) is 400 m thick in wells. The environment was low energy, clear waters, probably middle shelf. The Tuna Limestone Formation (Early Oligocene) is 60 m thick in wells and consists of limestone with minor shale and siltstone. The environment varies from inner shelf to outer shelf. The Naryansarovar Formation (Upper Oligocene) is 47 m thick in well. It is consisting of dirty white, grayish, brownish, hard massive, compact and fossiliferous limestone, greenish grey, feebly calcareous and fossiliferous claystone and colourless fine grained, sub-rounded sandstone. The environment was shelf. The Godhara Formation (Miocene) is 1200 m thick and consists of shale/claystone/limestone alternations and minor sandstones. It

was deposited in inner shelf environment. The Chhasara Formation (Early to Middle Burdigalian) consist of alternations of limestone bend and politic claystone. The environment of deposition of this formation was varying from marginal marine to shallow inner-shelf.

The Cenozoic sequence of Kachchh offshore basin is marked by prominent unconformities and influenced more by carbonate sedimentation along with alternations of shale and siltstone. The most of the Cenozoic sediments of Kachchh offshore basin was deposited in the shelf environment. The calcareous algae have multifarious applications in hydrocarbon exploration such as in biostratigraphy, as potential tool for reconstruction of paleoenvironment, as builder of carbonate reservoir rocks and reefs (Kundal, 2010). The different types of carbonates deposited, especially during Cenozoic Era in the shelf environment were suitable for luxuriant growth and accumulation of calcareous algae (Wray, 1977).

The present candidate expects presence of calcareous algae in the seven formations, namely, Nakhtarana Formation (Thanetian, Late Paleoecene); Jakhau Formation (Ypresian, Early Eocene); Fulra Limestone Formation (Late Middle Eocene); Tuna Limestone Formation (Rupelian, Early Oligocene); Naryansarovar Formation (Upper Oligocene); The Godhara Formation (Miocene) and Chhasara Formation (Early to Middle Burdigalian). Out of the five aforementioned formations, only two formations, namely Fulra Limestone Formation (Late Middle Eocene) and Chhasara Formation (Early to Middle Burdigalian) are present in Kachchh onland as well as Kachchh offshore and remaining four formations, namely, Nakhtarana Formation (Thanetian, Late Paleocene); Jakhau Formation (Ypresian, Early Eocene); Tuna Limestone Formation (Rupelian, Early Oligocene) and Naryansarovar Formation (Upper Oligocene) exclusively present only in Kachchh offshore basin.

The onshore Cenozoic sequence of Kachchh Basin is not promising due to limited thickness but, offshore Cenozoic sequence appears to me highly promising as the sequence and facies are same as in Mumbai Offshore Basin (Biswas, 2008). Extensive work has been done on calcareous algae from Cenozoic sediments of Kachchh onland basin (Humane and Kundal, 2005, 2010 and references therein; Kundal and Humane, 2006, 2007a, 2007b and Singh et al. 2010). However, no work so far is done on calcareous algae from Kachchh offshore basin. Hence, present candidate proposes to work on calcareous algae from Cenozoic sediments of Kachchh offshore basin. In addition to calcareous algae, the candidate also proposes to study sedimentology of the Cenozoic sequence.

(2) Aims and objects:

(a) Taxonomic documentation of calcareous algae from Cenozoic sediments of Kachchh offshore basin

(b) Sedimentology (sedimentary petrography and identification of facies) of Cenozoic sediments of Kachchh
offshore basin
(c) Reconstruction of paleoenviornments of Cenozoic sediments of Kachchh offshore basin based on calcareous algae
(d) Significance of calcareous algae in hydrocarbon exploration, i.e. identification of reservoir rocks and reefs for hydrocarbon accumulation in the Cenozoic sediments of Kachchh offshore basin based on calcareous algae.

(3) Plan of Work:

(a) Literature Survey
(b) Visit to Regional Geoscience Laboratory, Oil and Natural Gas Commission, Panvel, Mumbai for collection of core samples.
(c) Preparation of thin sections for study of calcareous algae.
(d) Systematic documentation of calcareous algae
(e) Sedimentology (sedimentary petrography and identification of facies)
(f) Reconstruction of paleoenvironments on the basis of calcareous algae.
(g) Significance of calcareous algae in hydrocarbon exploration

(4) Chapter Scheme:

The Ph.D. thesis will encompass seven chapters. Introduction of the area , aims and objectives and methodologies will be given in Chapter I, while the review of previous work will be included in Chapter II. The Chapter III will have geology and lithological description of core samples. The Chapter IV will include Sedimentology, i.e. (sedimentary petrography and identification of facies. The Systematic description of calcareous algae will be provided in Chapter V. The Chapter VI will include paleoenvironmental reconstruction based on calcareous algae and Sedimentology and Chapter VII will entail significance of calcareous algae in hydrocarbon exploration.

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